



Missouri Department of Natural Resources

Total Maximum Daily Load Information Sheet

Big Creek

Water Body Segment at a Glance:

County: Harrison
Nearby Cities: Bethany
Length of impaired segment: 22 miles
Length of impairment within segment (Pollutant): 1.0 mile (Ammonia)
6.0 miles (Low Dissolved Oxygen)
Source: Bethany Wastewater Treatment Plant
Water Body ID: 0444



State Map Showing Location of Watershed

Scheduled for TMDL development: 2012

Description of the Problem

Beneficial uses of Big Creek

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health (Fish Consumption)
- Public Drinking Water Supply

Use that is impaired

- Protection of Warm Water Aquatic Life

Standards that apply

- In the Missouri Water Quality Standards, found in 10 CSR 20-7.031 Table A, the criterion for dissolved oxygen, or DO, in streams is a minimum of 5.0 mg/L (milligrams per liter or parts per million).
- The criteria for ammonia vary with water temperature and pH. At typical temperatures and a pH value of 7.8, ammonia criteria would be 1.5 mg/L in summer and 3.1 mg/L in winter (chronic). These values are taken from Table B3 in 10 CSR 20-7.031. From Table B1, the acute criterion at this pH is 12.1 mg/L.

Background information and water quality data

The Bethany Wastewater Treatment Plant, or WWTP, discharges to Big Creek, a tributary of the Grand River, in northern Missouri. Water quality conditions in Big Creek are not protective of

aquatic life. In water quality studies conducted by the department in July and Sept. 2003, the creek was found to be high in ammonia. Ammonia is a common by-product of wastewater treatment and, under certain conditions, can be toxic to aquatic life. The acute¹ ammonia standard was exceeded on three days (data in table). The chronic ammonia standard is based on a 30-day exposure, which could not be established by these shorter term studies. Even so, the ammonia criterion was consistently violated during low flow conditions, conditions which can persist in this portion of Big Creek for more than 30 days.

Ammonia as Nitrogen in Big Creek*

Site	Sample Date	NH3-N (mg/L)
3	23-Jul-03	13.4
3	24-Jul-03	11.2
3	3-Sep-03	17.9
3	4-Sep-03	15.6
2	23-Jul-03	1.96
2	24-Jul-03	1.83
2	3-Sep-03	9.45
2	4-Sep-03	8.71
1	24-Jul-03	0.01499
1	3-Sep-03	0.01499
1	4-Sep-03	0.01499

*shaded cells indicate exceedance of water quality criteria

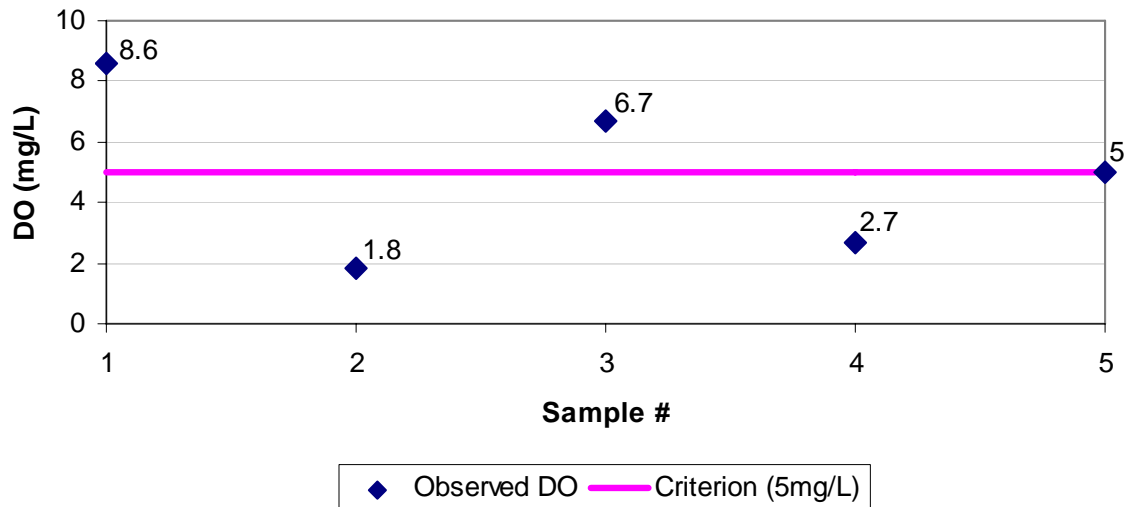
For dissolved oxygen, if more that 10 percent of measurements in a water body fail to meet the water quality criteria, that water body is judged to be impaired. During the 2003 studies, low levels of dissolved oxygen were documented in Big Creek in six of 11 samples (54 percent) taken from sites below the Bethany WWTP. The data from these samples are summarized in two charts on the next page.

Wastewater effluent that is high in biochemical oxygen demand, or BOD, will lower the dissolved oxygen in a stream and stress or be lethal to the aquatic organisms that require dissolved oxygen to survive. Like all wastewater discharges in Missouri, the Bethany WWTP must meet the requirements of a discharge permit issued by the Missouri Department of Natural Resources. The limits in this permit can be adjusted to prevent the creek from being impaired.

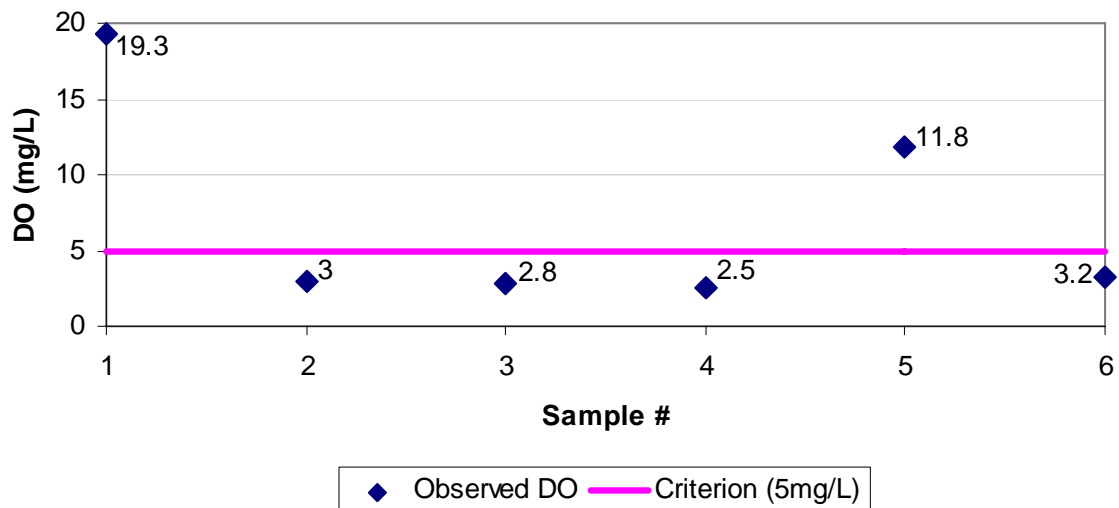
A map, showing the impaired segment of Big Creek and department sampling sites, can be found on the last page of this information sheet.

¹ Acute criteria apply to short exposures to toxic conditions that aquatic creatures can survive without harm. Chronic criteria apply to conditions of constant exposure and are much lower than the acute criteria.

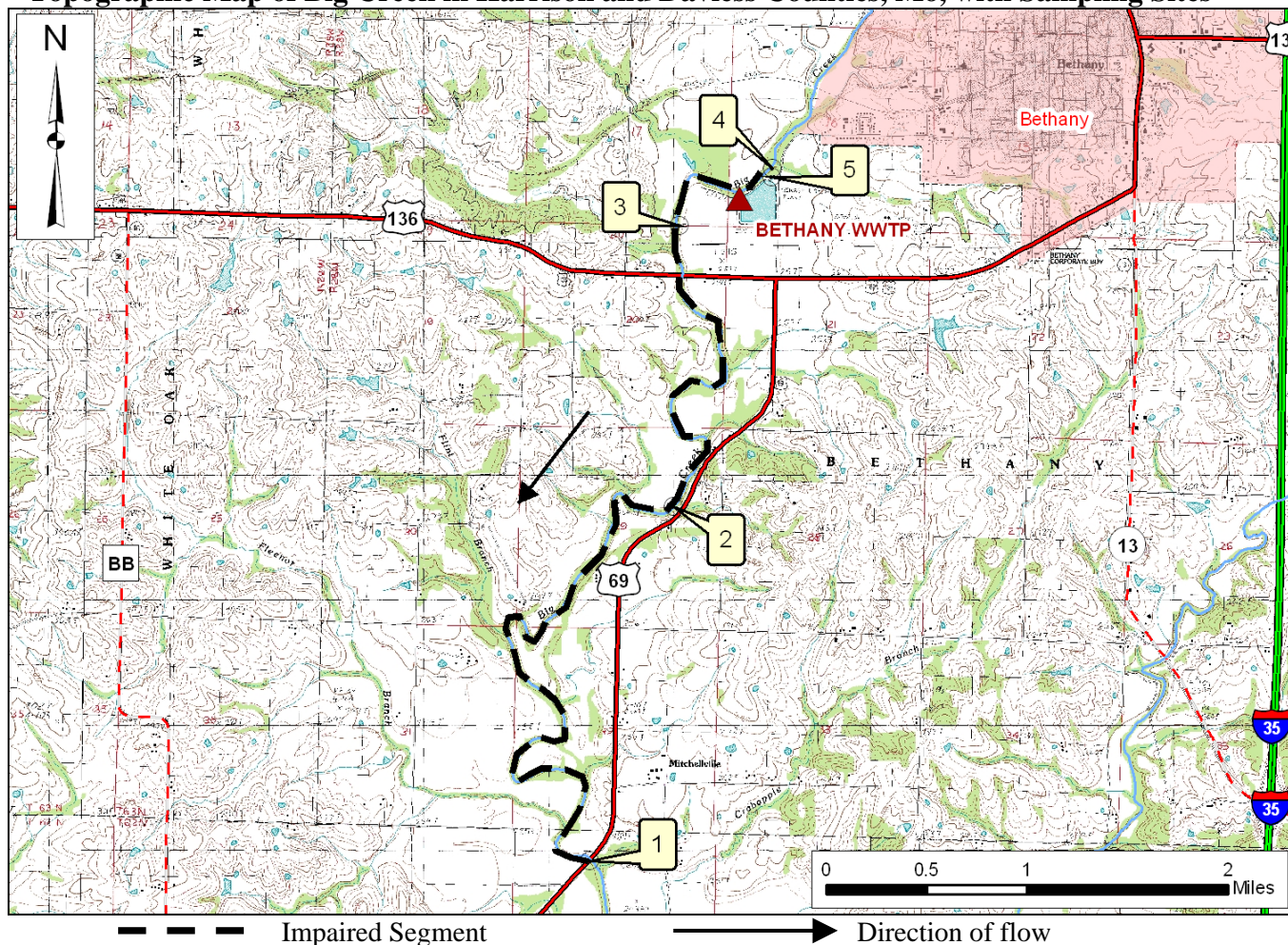
**July 2003 Dissolved Oxygen (DO) measurements
for Big Creek taken below Bethany WWTP**



**September 2003 Dissolved Oxygen (DO) measurements
for Big Creek taken below Bethany WWTP**



Topographic Map of Big Creek in Harrison and Daviess Counties, Mo, with Sampling Sites



Sample Sites

- 1 – Big Creek 6.0 miles below Bethany WWTP
- 2 – Big Creek 2.6 miles below Bethany WWTP
- 3 – Big Creek 0.9 miles below Bethany WWTP
- 4 – Bethany WWTP Outfall
- 5 – Big Creek 0.1 miles above of Bethany WWTP

For more information call or write:

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Water Protection Program

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